



n this issue of *Goddard Tech Transfer News*, we are highlighting the importance of inventions and contributions awards to Goddard for the center's technologies and to our innovators.

Applying for awards both within and outside of NASA can be challenging—a good award application takes time and consideration. But these efforts are well worth it, given the potential return.

Goddard innovators who receive awards benefit from professional recognition from their peers, and this recognition also may provide pathways to further professional advancement. Awards also help to promote Goddard innovations to organizations and industries beyond our center and NASA—providing added credibility to Goddard technologies and aiding in technology transfer efforts. Finally, awards bring cross-industry and NASA-wide recognition to Goddard for the innovative technologies being developed here.

Many awards are available to Goddard innovators and their innovations, both within the center and throughout NASA. NASA-wide awards for technology innovation are administered by the agency's Inventions and Contributions Board (ICB). The ICB honors notable new inventions and their innovators through cash awards and recognition.

In this issue of *Goddard Tech Transfer News*, we introduce you to Goddard's representatives on the ICB, who give some insight into the award process and its benefits (see pages 6–7). You also meet Goddard's Awards Liaison Officer, Dale Clarke, who is based in the center's Innovative Partnerships Program (IPP) Office and plays a key role in securing ICB recognition for Goddard innovators.

As always, I trust you will find this issue of our magazine to be of benefit to your understanding of Goddard's work and achievements.

Nona Cheeks Chief, Innovative Partnerships Program Office (Code 504) NASA's Goddard Space Flight Center

Navigator GPS Broadens Capabilities of NASA Missions

illions of people around the world rely on global positioning system (GPS) devices for navigation and guidance. Because GPS signals are transmitted only toward Earth, not away from it, GPS signals seen below the GPS constellation are strong and plentiful, but signals seen above the constellation are weak and sparsely available. Because of this, spacecraft operating above the GPS constellation orbits, as in geosynchronous Earth orbit (GEO) and highly elliptical Earth orbit (HEO), have not previously been able to use GPS-based navigation.

Identifying this deficiency, the guidance and navigation hardware group (Code 596) at NASA's Goddard Space Flight Center brought together a team of highly skilled engineers to develop an autonomous, real-time, radiation-hardened GPS receiver, called the "Navigator," designed specifically to operate in high-altitude orbits.

"We saw a gap in the existing technology, so we set out to develop a higher sensitivity GPS receiver, one capable of autonomously operating in high-altitude orbits," said Luke Winternitz, lead architect of the Navigator GPS receiver.

This state-of-the-art receiver implements a massively parallel search for GPS signals using new signal-processing algorithms and dedicated signal-acquisition hardware. This capability sets it apart from previously available space-based GPS receivers, whose acquisition techniques generally use serial search methods that cannot efficiently process weak signals.

Awards, Accolades, and Applications

The Navigator team filed a New Technology Report (NTR) for the GPS receiver in 2004. Since that time, the technology has won numerous awards, played an important role in several critical NASA missions, and drawn the attention of industry leaders eager to explore licensing opportunities.

The Navigator had its first flight validation in 2009 on the Hubble Space Telescope Servicing Mission 4 as part of the relative navigation sensor experiment. Fully flight-qualified,



The Navigator GPS technology flew for the first time on the Hubble Space Telescope's fourth servicing mission in 2009.

Navigators are currently being developed as critical navigation sensors for two NASA missions: the Magnetospheric MultiScale (MMS) mission, which will operate well above the GPS constellation, and the Global Precipitation Measurement (GPM) mission. Engineering-model GPS receivers have also been developed for the Geostationary Operational Environmental Satellite R-Series (GOES-R) program and the Air Force Research Laboratory (AFRL) Plug-and-Play spacecraft. The core technology of the Navigator will be integrated into a GPS receiver currently being developed by Honeywell for the Orion space capsule.

"The ultimate desire of any engineer or inventor is that their invention gets used. Our design is getting recognition, and the receiver is being used on NASA missions, so we're thrilled," said Steve Sirotzky, hardware lead on the Navigator GPS receiver at Goddard.

In 2010, Broad Reach Engineering, an aerospace engineering firm, licensed the Navigator GPS receiver. It plans to use the technology in a GPS system for AFRL's Autonomous Nanosatellite Guardian for Evaluating Local Space (ANGELS) mission, which will operate at GEO.

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The Navigator GPS Team (L–R): Rick Butler, Philip Baldwin, Andrew Maynard, Anthony Marzullo, Dr. John Carl Adams, Dr. Luke Winternitz, Albin Hawkins, John Shanley, Jeffrey Surber, Austin Lanham, Mark Brady (standing), Dr. William Bamford (seated), A. Vincent Banes, Steve Sirotzky, Loc Luu, Harry Stello III, and Dr. Jason Mitchell. Not pictured: Maryam Bakhiari Nejad, Gregory Boegner, Milton Davis, Colby Goodloe, Gregory Heckler, Rishi Kurichh, Tyler Lulich, Kenneth McCaughey, Samuel Price, and Miriam Wennersten.

Dale L. Clarke is the awards liaison officer in the Innovative Partnerships Program (IPP) Office at NASA's Goddard Space Flight Center. In this interview, Clarke discusses eligibility for Inventions and Contributions Board (ICB) awards, how the winners are determined, and how awards help promote the development of innovations that contribute to NASA missions and the nation.

Can you start by sharing the history and purpose of the ICB awards?

The ICB awards date back to the National Aeronautics and Space Act of 1958, which formed NASA and initiated the flow of new technologies to the public. For the past 50 years, the ICB has distributed millions of dollars for thousands of innovations that have enhanced the nation's space program and the quality of life for all U.S. citizens. The purpose of the awards is to provide an incentive for innovators by rewarding efforts to develop new technologies—including software—that advance NASA missions.

What awards can NASA innovators receive?

There are three "Initial Awards" that inventors are eligible to receive upon filing a New Technology Report (NTR).

- **Tech Brief Awards:** Granted upon documentation of approval of an article for publication in *NASA Tech Briefs* magazine
- **Software Release Awards:** Granted upon completing the software release process
- Patent Application Awards: Granted upon patent application filing

Innovators do not need to apply for these Initial Awards. Rather, the awards liaison officer at each NASA center, based on a review and recommendations by an internal team of IPP and Patent Office staff, submits an Initial Award request to the ICB for each eligible inventor. Innovators who receive these event-driven awards receive a fixed amount of compensation based on the type of award.

Another category of awards, "Board Action Awards," are granted by the ICB for innovations that provide a significant value to NASA aeronautics or space activities. Applicants for Board Action Awards must complete a NASA ICB Board Space Act Award Application (NASA Form 1329), which is submitted to the ICB by the NASA center that sponsors the technology. The ICB reviews the information in NASA Form 1329 to identify the value of the innovation and can award a monetary prize based on the determined level of value. An innovation can receive multiple Board Action Awards as the technology is enhanced over time, with the total usually limited to \$100,000, though the Space Act permits awards in excess of \$100,000 with the approval of Congress.

NASA also holds yearly competitions to recognize exceptional innovations in the categories of Software of the Year and Invention of the Year. Each center may submit one nominee for Software of the Year, which is co-sponsored by the Office of the Chief Engineer, the Office of the Chief Information Officer, and the Office of Safety and Mission Assurance.



Dale Clarke

(L-R): Milelene Gunyon, Dale Clarke and Regina Martin.

A special Software Advisory Panel reviews documentation and presentations by the nominees and recommends winners to the ICB. The NASA General Counsel selects the Invention of the Year Award and is supported by the ICB with technical assistance, publicity, and monetary awards. Awards can be given in Government and Commercial categories, and each center may submit up to two nominations.

(See page 9 for more information about these awards.)

What is your role and how do you interact with the ICB?

All award applications are submitted through the awards liaison officer, so working with the ICB is one of my main responsibilities. But reviewing technologies and submitting applications for awards is a team effort at Goddard. Every month, the IPP Office and the Office of Patent Counsel meet to conduct New Technology Assessments (NTAs) on new technologies, including software. Each new technology is assigned an IPP technology manager and a patent attorney who present the technology to the team. The technology manager determines the potential impact of these technologies, both within NASA and commercially. Possible determinations include whether to pursue a patent for a technology, send it to NASA Tech Briefs, and/or whether to pursue the software release process for a software innovation.

Outside of serving on this team, I am also a liaison between Goddard innovators and the awards process. I actively seek out exciting new technologies that are candidates for awards.



All photos on these pages are NASA photos by Bill Hrybyl

This includes encouraging inventors to fill out an NTR for their invention. And when we conduct monthly NTAs, I listen closely to the presentations and consider which technologies are good candidates for Board Action Awards. When the potential is evident, I encourage the inventors to pursue an award by completing the NASA Form 1329, and I work with them to develop their application.

What tips would you have for an inventor who is interested in pursuing an award?

First and foremost, the inventor must submit an NTR for the new technology. To receive any ICB award, an invention must be reported by the sponsoring center and assigned a tracking number as an official indication that NASA has an intellectual property interest in the invention. This is done via the NTR process. You can have the best invention in the world, but if we don't know about it, it can't win an award. The NTR helps us to know about your invention.

Also, it is very important to show the impact of the invention not only for NASA but also for the general public and other entities outside of NASA. This is particularly important for Board Action Awards and annual external-to-NASA competitions. When filling out the NASA Form 1329 application, be sure to include information about how many people are impacted by the innovation and how the technology has been or may be used in commercial or other government applications.

Who makes up the ICB and what is its role?

The ICB is chaired by NASA Chief Engineer Mike Ryschkewitsch and is composed of representatives from across the agency who reflect the finest technical talent and whose expertise covers more than 40 fields of science and technology. Goddard has four representatives on the 19-member Board:

- · Christa D. Peters-Lidard, PhD
- · Sandra A. Cauffman
- David C. McComas
- John Bristow

(See the interview with Goddard's ICB members on pages 6-7.)

The ICB is responsible for reviewing award applications from the various centers and determining award winners and award amounts based on the value of the inventions that are submitted for the Board's consideration. The ICB is assisted by four staff members who carry out the administrative activities of the awards process, led by Anthony J. Maturo, ICB staff director.

How do awards help NASA and individual inventors?

Awards benefit everyone. The inventors receive recognition from their peers for their technology, and the cash prize is a nice perk. The awards help bring recognition to NASA and the individual centers for some of the great technologies that NASA is developing. Ultimately, the awards are incentives for the development of new technologies that benefit NASA and the public. By helping secure these awards for Goddard innovators and their technologies, the IPP Office continues in its mission to accelerate technology development.



Dale Clarke

years with NASA: 25

years with NASA's IPP Office: **10**

position:

Goddard Awards Liaison
Officer since 2002

Goddard's Representatives on NASA's Inventions and Contributions Board (ICB)



John O. Bristow

Ground Segment Lead System Engineer (Code 581)

Geostationary Operational Environmental Satellite R-Series (GOES-R)

Appointed to ICB: 2009



Sandra A. Cauffman

Manager, Gravity and Extreme Magnetism SMEX (GEMS) Project (Code 463)

Appointed to ICB: 1994

ASA's Goddard Space Flight Center has four representatives on NASA's Inventions and Contributions Board (ICB). Each of Goddard's representatives brings diverse experience and a unique perspective to the ICB. Sandra A. Cauffman, manager of the Gravity and Extreme Magnetism SMEX (GEMS) Project, was the first female appointed to the Board in 1994, and she is the longest serving member of the ICB. Christa D. Peters-Lidard, PhD, who heads the Hydrological Sciences Branch, has served on the Board since 2007. David C. McComas, senior flight software engineer, and John O. Bristow, ground segment lead system engineer for the Geostationary Operational Environmental Satellite R-Series (GOES-R), were both appointed in late 2009.

Goddard representatives also have experience winning awards for technologies they helped to develop. Dr. Peters-Lidard was lead on the team that was recognized in 2005 as co-winner for the NASA Software of the Year Award for the Land Information System (LIS) Software v. 4.0 (GSC-14997-1). Bristow was on the team that won honorable mention for the NASA Software of the Year Award in 2006 for the Goddard Mission Services Evolution Center (GMSEC) architecture, message bus, and application programming interface (GSC-15142-1 and others). He was also part of teams that won runner-up in 2008 for the next-generation GMSEC system and in 2002 for the AutoCon: Autonomous Maneuver Control Flight Software (GSC-14629-1). McComas has received several Initial Awards and was part of the team that won a Board Action Award in 2008 for GSC-15144-1 and GSC-15157-1, the Core Flight Executive (cFE) Software with an application programmer's interface.

In this article, Goddard's ICB members share their perspectives on the Board and suggestions for how innovators can utilize awards to promote their inventions.

David and John, why did you recently decide to join the ICB, and what do you hope to accomplish as Board members?

McComas: Technology is integral to what we do at Goddard. Serving on the ICB lets me be part of recognizing innovations, and it exposes me to different innovations throughout NASA. In my day-to-day work I am very focused on my current projects, so serving on the Board helps me to keep an eye on the broader mission of NASA.

Bristow: I thought my experience submitting award applications for my own technologies would give me an important perspective as a Board member. My goal is to be a champion for the submitters. I want to make sure applicants are judged fairly and that they are acknowledged for not only the work they do to develop new technology but also the follow up work they do to get the technology incorporated into NASA missions.

Sandra and Christa, what have you enjoyed most about serving on the ICB?

Cauffman: When I was asked to consider joining the Board in 1994, I did not know anything about it. NASA Headquarters asked Goddard to appoint a representative, and I was approached. At the time, I was the first female and the first minority on the Board. Now I am the longest serving member of the Board.

I am blessed that I have been able to serve on the Board for so long. It helps me keep in touch with so many cutting-edge and state-of-the art inventions. The quality of people at NASA and the innovations they create are amazing. NASA is responsible for so many new ideas and products that we sometimes take it for granted. The awards help recognize these outstanding achievements.

Peters-Lidard: It really is amazing all of the things that we are asked to evaluate. Some of the inventions are outside my area of expertise, which has helped me to learn a lot. These technologies save taxpayers millions of dollars, and many go on to be commercialized and have great applications in the commercial market.

Why are awards important?

Cauffman: People at NASA love what they do, and the work is very rewarding, but it is always nice to recognize people for going above and beyond the call of duty. Awards help to market inventions, promote inventors, and encourage inventors to find new and different uses for their technology.

Bristow: We put in a lot of work to develop the applications for GMSEC and AutoCon, but it was well worth the effort. After winning runner-up and honorable mention for the NASA Software of the Year Award, I got recognition and calls from colleagues at Goddard and other NASA centers, which was very satisfying. It also opened the door for professional advancement. I am sure the awards are part of the reason I was named ground segment lead engineer for GOES-R.

McComas: We were encouraged to submit a NASA ICB Board Space Act Award Application (NASA Form 1329) for the cFE software, and I am glad we did. In addition to the recognition our team received, submitting the application made us take a step back and look at the big picture of how the technology could be used in the future to benefit NASA and in the commercial market.

Peters-Lidard: The award we won for LIS was recognition for the great team we had and the potential benefits of what we developed. It helped to establish credibility for the innovation, which has led to additional research and development and transfer of the technology for other uses. Another exciting aspect of the project is that LIS is science—not flight or engineering—software, so the award helped bring some additional recognition to the scientists, who don't always think of themselves as inventors and don't usually think of what they do as technology.

What advice would you give an inventor who is interested in pursuing an award?

Bristow: Most innovators like to develop technology, but they also need to sell it and champion it. That is not always a natural thing for inventors to do. Pursuing an award can take a lot of time. However, in the end it is well worth it. Submitting award applications makes other centers and other outside entities aware of the technology, which can help create a future for the invention long after the original purpose of the technology has been fulfilled. If inventors don't promote their technologies, even the best inventions will fade. Unfortunately, I think we are losing a lot of good technologies that way.

Peters-Lidard: Inventors need to report their new innovations so they can get the recognition they deserve. There is some reluctance to shout our own praises because of a culture of not always doing so. We all share in the responsibility of increasing the amount of reporting of new technologies at Goddard. We have won some major awards at Goddard, so we have award-winning examples to show inventors. Don't underestimate the potential to win and the benefit—which can be fairly lucrative—of winning awards.

Cauffman: When filling out award applications, inventors should be creative in how they explain their innovation. They especially need to highlight how the technology is impacting—or has the potential to impact—NASA missions and the commercial marketplace.

McComas: For inventors, schedule and time are often driven by projects. When someone suggests registering an innovation or submitting an award application, it is easier to shy away and move forward with other projects. But it is worth it to take the time and fill out the New Technology Report (NASA Form 1679) or NASA Form 1329. ■



David C. McComas
Senior Flight Software Engineer, Flight

Software Systems Branch (Code 582)
Flight Software Product Lead, Global

Precipitation Measurement (GPM)

Appointed to ICB: 2009



Christa D. Peters-Lidard, PhD

Branch Head, Hydrological Sciences Branch (**Code 614.3**)

Principal Investigator, Land Information System (LIS)

Appointed to ICB: 2007



NASA Inventions and Contributions Board Awards

The following awards were issued by ICB during the second quarter of fiscal year 2010

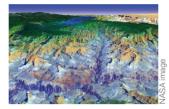
Board Action (SAA) Awards

James (Bryan) Blair, Vibart (Stanley) Scott, and Luis Ramos-Izquierdo (all Code 694) for their work on

Active, Solid-State, 3-Dimensional Range Imaging System

This technology is useful for numerous applications where 3-D information in image form is required for study, digital manipulation, and monitoring. Those applications include vehicle safety, robotic operations,

semi-autonomous or autonomous robotic docking, target surface characterization and monitoring over time, and planetary surface mapping. Its simplified design dramatically increases reliability, accuracy, imaging capability, ruggedness, and service life of the measurement system.



Kongpop U-Yen, Edward Wollack, and Terence Doiron (all Code 555) for their work on **Compact Low-Loss Planar Magic-T**

This technology boosts signal receptivity for improved measurements by microwave and millimeter-wave antenna networks. It reduces signal loss,



improves broadband response, and offers simplified integration. The Magic-T also is less expensive than other methods to produce and maintains good in-band performance. It has been used on NASA's Aquarius mission, the Soil Moisture Active and Passive (SMAP) mission, and the Beyond Einstein probe (CMBPol).

Samuel Moseley (Code 660), David Chuss, and Giles Novak (both Code 665) for their work on

Millimeter Wave Polarization Transformer

This new method for achieving polarization transformation of light in the far infrared to millimeter wave region is unique because it modulates differential path distance between linear orthogonal polarizations via translational motion. This improved approach is a dramatic technical advancement with benefits for astronomical polarimetry. Furthermore, infrared versions of this innovation may have applications in intelligence imaging and surveillance.



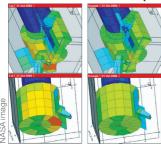
Steve Sirotzky (QSS), Gregory Boegner (Code 567), and Luke Winternitz (Code 596) for their work on

Radiation Hardened, Fast Acquisition/Weak Signal Tracking GPS Receiver Originally known as Pivot 2.0, this technology is now known as the

Originally known as Pivot 2.0, this technology is now known as the Navigator GPS receiver (see page 3).

David Hughes (Code 546) for his work on

Surface Interaction Model (SIM) for Enhanced Particulate Distribution Analysis



The SIM is an algorithm to determine a particle's interaction with a surface using four particle behavior parameters. Inserting the SIM into a larger particle transport simulator allows for a more accurate picture of particle behavior, which is of particular importance in the contamination analysis of spacecraft as well as in nonaerospace applications, such as microelectronics.

Other ICB Awards

Patent Application Awards

High Field Superconducting Magnets

by Thomas Hait and Peter Shirron (both Code 552)

Hybrid Architecture Active Wavefront Sensing and Control System and Method

by Tristram Hyde (Code 590), Bruce Dean (Code 551), and Lee Feinberg (Code 550)

Low-Temperature Radiometer

by Thomas Hait, Michael DiPirro, and James Tuttle (all Code 552)

Method of Improving System Performance and Survivability through Self-Sacrifice by Michael Hinchey (Code 585)

Methods of Determining Complete Sensor Requirements for Autonomous Mobility by Steven Curtis (Code 695)

Step-Frequency Inverse Synthetic Aperture Radar (ISAR) by Manohar Deshpande (Code 600)

Tech Brief Award

Cryogenic Pupil Alignment Test Architecture for Aberrated Pupil Images

by Brent Bos, David Kubalak, Scott Antonille, Raymond Ohl, and John Hagopian (all Code 551)

IPOPP Selected as Software of the Year Nominee

The International Polar Orbiter Processing Package (IPOPP) has been selected as Goddard's nominee for NASA's 2010 Software of the Year Award. Led by innovator Patrick Coronado (Code 606.3), IPOPP will be recognized at the annual Innovative Partnerships Program Office's New Technology Reporting Program in October. IPOPP also will participate in the agency's 17th annual NASA Software of the Year Award competition in July. (For more information about the prestigious NASA-wide award, see page 9.)

IPOPP is a real-time science data processing framework that enables scientists to visualize and evaluate direct readout Earth science data. The framework supports the generation of products for use in decision and forecast models, such as fire detection, vegetation monitoring, weather forecasting, and land and sea surface temperature tracking. Currently used to process the Earth Observing System's Terra and Aqua mission data, IPOPP can be used to process data from all future Earth science missions.

The panel selecting Goddard's nominee for the NASA award was chaired by Scott Green (Code 583) and included representatives from across six center directorates: Susan Sekira (Code 300), Jeanne Behnke (Code 400), Manuel Maldonado (Code 500), Long Pham (Code 600), April Hildebrand (Code 700), and Ronald Walsh (WFF/Code 800).

ICB Award Requirements

To receive any awards from the ICB, the subject invention must have been officially reported and received a tracking number from the IPP Office to indicate that NASA has an intellectual property interest in it. The Goddard awards liaison officer (ALO) will also need a home address and Social Security or Tax ID number from each inventor to enter in the NASA agencywide database. The ALO also needs input from the inventors to verify that an aerospace origin, tie, use, or potential use exists for each technology to qualify for the award.

Initial Awards

There are three Initial Awards that are awarded once only upon the documentation of specific events in NASA's Technology Tracking System (NTTS). There is no paper application for these since they must be requested through the sponsoring center's Awards Liaison Officer. These award types and associated qualifying events are:

- Tech Brief Awards (\$350 per inventor, max. 14 inventors): Upon the documentation of approval of an article for publication in NASA Tech Briefs magazine by the sponsoring center, the ALO notes the approval date in NTTS and submits award requests for each inventor.
- Software Release Awards (\$1,000 for a single inventor, or \$500 each for up to 10 inventors): Upon the documentation of the initial non-developmental use of software in NTTS, the ALO submits award requests for each inventor.
- Patent Application Awards (\$1,000 for a single inventor, or \$500 each for up to 10 inventors): Upon the documentation of the serial number for a Non-Provisional Patent Application, or the issuance of a Divisional or Continuation In Part patent, the ALO requests awards for each inventor. Provisional Patents, Continuation Patents, and Foreign Patents are not eligible for these awards.

Board Action Awards

Board Action Awards are more value driven than the event-driven Initial Awards and have no set amount. Applicants complete NASA Form 1329, which is designed to convey the value of the award to the ICB. The ICB relies on the information in this form to determine the award amount, if any, that the technology deserves. Technologies may be submitted for Board Action Awards at any time and may be re-evaluated by the submission of NASA Form 1329A.

NASA Invention of the Year (IOY) Award

The IOY competition is an important part of the NASA patent program. NASA awards the IOY Award in two categories each year—Government and Commercial—and each center may submit up to two nominations. The eligibility requirements for the NASA Commercial IOY Award are tied closely to the National Inventor of the Year competition promoted by the Intellectual Property Owners (IPO) Educational Foundation, enabling NASA to submit the winner of its Commercial IOY award each year to the IPO's competition.

The NASA General Counsel selects the IOY Award, which is supported by the ICB with technical assistance, publicity, and monetary awards. The application package includes NASA Form 1329 (or Form 1329A if a prior 1329 is on file) as well as other documentation, as outlined in the call for nominations, which is usually issued in the fall.

NASA Software of the Year (SOY) Award

Excellence in aerospace software is vital to NASA's leadership role in developing aeronautics and space technologies and transferring them to government and industry. The prestigious SOY Award is designed to give recognition to developers of exceptional software created for or by NASA and owned by NASA. The competition allows the agency to recognize and appreciate the NASA team members who set high standards for significant software that is creative, usable, transferable, and possesses inherent quality.

Every NASA center and facility can participate in this annual competition, which requires the completion of NASA Form 1329 (or Form 1329A if a prior 1329 is on file) as well as the NASA Software Summary Evaluation Document. Winners receive a NASA Software Medal, ICB certificate(s), and monetary compensation.

With support from the ICB, the Office of the Chief Engineer, the Office of the Chief Information Officer, and the Office of Safety and Mission Assurance sponsor the selection of the winning innovation. A special Software Advisory Panel reviews documentation and presentations for each center's nomination and recommends winners to the ICB.

The 2010 SOY Award competition is underway, with results expected to be announced in the fall. \blacksquare

Navigator GPS Broadens Capabilities of NASA Missions

Continued from page 3

"We knew that if we could develop a flight-capable receiver that it would be of value in NASA missions and perhaps draw interest from outside industry as well. The Innovative Partnerships Program (IPP) Office has helped promote the Navigator by encouraging us to apply for awards and by marketing the technology to commercial industries," Winternitz said.

The Navigator team continues to refine its next-generation GPS receiver.

"We keep trying to push what can be done with GPS, to reach higher altitudes and more extreme operating requirements," said Winternitz. "The goal is to continue to push the limits of applicability for space-based GPS navigation, potentially even enabling GPS-based navigation and timing as far away as the moon."

Navigator GPS Awards and Technology Transfer Achievements

- Tech Briefs Award April 21, 2004
- Patent Application Award December 14, 2005
- License to Ocean Tomo for live IP auction July 22, 2008
- Patent received June 16, 2009
- Space Act Award Invention of the Year Nomination March 31, 2010
- Technology license to Broad Reach Engineering In process

SBIR Projects Yield Technologies Needed by NASA and Industry

he Small Business Innovation Research (SBIR) program, which is administered by NASA's Innovative Partnerships Program (IPP), gives small high-tech companies the opportunity to participate in government-sponsored research and development (R&D). The program's specific objectives are to stimulate U.S. technological innovation, use small businesses to meet federal R&D needs, increase private-sector commercialization of innovations derived from federal R&D, and foster and encourage participation by socially disadvantaged businesses.

Highlighted here are five examples of SBIR contracts that have produced innovations that can benefit NASA missions and are yielding commercial success for the small businesses.

Precise Measurement of Aspheric Optics

As NASA's exploration of the universe continues to advance, the size and accuracy of its telescope mirrors must accommodate increasingly ambitious scientific missions. To study far-flung galaxies, NASA's telescopes require a very large primary mirror and

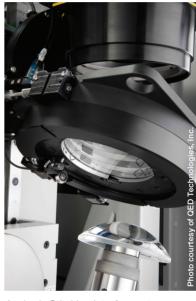
a smaller, convex mirror. The smaller, aspherical mirrors have the advantage of enabling extraordinarily sharp images, but aspheres are difficult to measure and manufacture.

Based in Rochester, New York, QED Technologies, Inc., developed a highly sensitive device called the Subaperture Stitching Interferometer (SSI®) for measuring spherical surfaces. This device uses a stitching technique that measures a series of sections, or subapertures, on an optical surface; compiles data from each section; and then stitches it together to obtain a complete measurement. Goddard awarded two SBIR contracts to QED to apply this same technology to aspheres.

The result was the Aspheric Stitching Interferometer (ASI®), which is fast, accurate, flexible, and affordable. NASA verified the technology on a high-precision, mildly aspheric "flight optic" as part of the PICTURE/SHARPI missions.

The company's ASI® instrument, which is capable of measuring almost any optical surface, including steep aspheres, sells for \$500,000, and QED Technologies has already sold systems across North America, Asia, and Europe. In addition to its benefits for NASA, the technology also can be applied to several commercial industries that require large, high-precision optical surfaces, including ground-based telescopes, lithography systems, and satellite and surveillance systems.

SSI and ASI are registered trademarks of OED Technologies, Inc.



Aspheric Stitching Interferometer

Parallel Computing and Analytically Capable Data Mining Engine

NASA missions deluge scientists with invaluable data and images to support groundbreaking work in Earth and space science. Vast stores of data are deposited in the Virtual Observatory, NASA's permanent archive for space science mission

1. Visualization

2. Object Selection

4. Object Recognition

3. Apply Data Mining Algorithms

Image courtesy of SciberQuest, Inc.

A new approach to data mining

data, but scientists and engineers had no way of organizing or leveraging the information to enhance their research.

In order to make these data more readily available to the scientific community, NASA awarded an SBIR contract to SciberQuest, Inc., a leader in remote data mining technologies. The company has helped NASA implement state-of-the-art data mining by creating an advanced computing infrastructure called Interoperable Distributed Data Engine (IDDat). IDDat acts as an add-on to the Virtual Observatory and supports processing and remote data analysis of high-volume and widely distributed data. A second piece of technology, called RemoteMiner, is a data mining engine that connects to the Virtual Observatory via IDDat and enables autonomous parallel mining of large data sets. These new capabilities provide NASA with the means to search, explore, analyze, and share data from previous spacecraft missions on site and remotely. SciberQuest is working with

Goddard on an ongoing basis to provide the analytical capability to support NASA missions.

In addition to providing analytics that will enhance future NASA missions, this technology has several commercial applications. SciberQuest is already selling this software, generating a revenue stream of approximately \$200,000 annually. The company continues to develop this software for use in the pharmaceutical, bioinformatics, and health care industries as well as for companies who specialize in fraud detection and network intrusion.

Radiation-Hardened Image Processing Computer

NASA spacecraft and Earth orbiters capture world-class images that provide one-of-a-kind glimpses into our universe. However, it can be a challenge to conduct real-time image processing and storage in the harsh space environment. To address this gap in the technology, Goddard awarded an SBIR contract to Space Micro, Inc., to develop a high-performance, radiation-hardened image processing computer for use in space.

Under the contract, Space Micro developed the IPC5000[™] image processing platform, which combines high-performance, low-power, radiation-hardened computing and high-speed mass memory to meet the challenges of space imaging environments. This collaboration has been an enormous success for both Space Micro and NASA, and now the Department of Defense (DoD) has a considerable stake in this technology as well. DoD awarded the company a \$4 million contract to develop an image processing system for an upcoming satellite mission.

Additional applications anticipated for this image processing technology include software design radio, hyperspectral imaging, logic reconfiguration, and high-speed data transfer.



C-OPS contains microradiometers the size of a pen; a hand deployment is shown for optical profiling in shallow coastal waters (2 m depth) and rivers.

IPC5000 is a trademark of Space Micro, Inc.

In Situ Radiometers for Oceanographic Research

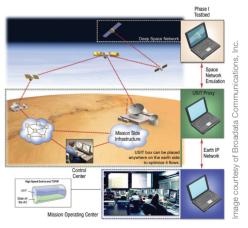
As NASA scientists and engineers explore the world ocean, they require more accurate and powerful technologies for environmental surveys, vertical profiles, coastal monitoring, and remote sensing. Working under an SBIR contract, Biospherical Instruments Inc. (BSI) developed an innovative instrument called the Compact-Optical Profiling System (C-OPS). This new instrument provides unprecedented capabilities to collect high-quality data through the use of high-speed microradiometer light sensors, which may be networked into complex instruments for oceanographic studies.

These new capabilities will greatly enhance NASA's scientific missions across the world ocean, all while providing more accurate data, reducing uncertainties in imaging, and improving scientific understanding of interactions between the ocean and Earth's atmosphere. In fact, BSI now has a contract with NASA to support the next generation of satellite-based marine research, specifically the Optical Sensors for Planetary Radiant Energy (OSPREy) system. NASA has already purchased a number of microradiometer systems, and BSI has had numerous commercial sales outside of NASA, including to several U.S. and international universities.

Universal Space IP Transparent Proxy

When NASA needed to reduce levels of mission funding and shorten mission development schedules, Internet Protocol (IP) technologies and architecture seemed like a possible solution. However, despite their huge potential (e.g., cost effectiveness, reduced development and installation times), IP technologies encounter significant performance problems in a space environment due to narrow bandwidth, long propagation delays, large transmission errors, and unreliable connectivity.

Broadata Communications, Inc., a company specializing in IP transmission equipment, proposed a Universal Space IP Transparent (USIT) Proxy solution in response to the SBIR annual solicitation. The company's innovative network protocol employs a unique, modularized architecture that provides accurate network measurements and reconfigurations to effectively overcome IP performance problems in space links. Broadata's USIT Proxy software system provides a tenfold improvement in network throughput when compared to existing state-of-the-art IP solutions.



Solution to space-based IP network performance

This innovative technology will support several NASA programs, including the IP Operational Networks, Tracking and Data Relay Satellite Systems, Deep Space Networks, beyond Earth multihop/relay communications, and direct line-of-sight near-Earth satellite communications. The USIT system has attracted customers from universities and local broadcasters, with commercial sales of \$200,000 annually. It can also be used in several other commercial applications, including wireless Internet access networks, radio frequency/microwave trunking links, commercial satellite networks, mobile enterprise networking, and packet cellular networks.

Space Micro's

IPC5000 image processing platform

Hasbro Partnership Will Help Educate Kids about NASA Spinoffs

he nation's third through eighth graders have a chance to compete for a brand new award that brings NASA together with Hasbro's OPTIMUS PRIME, the TRANSFORMERS character who seeks to benefit humanity.

Known as the NASA OPTIMUS PRIME Spinoff Award, this competition encourages youth to learn about NASA spinoff technologies.



"By leveraging the similarities between the popular TRANSFORMERS character and the spinoff of NASA-developed technologies to the private sector, we have a chance to greatly contribute to children's interest in STEM—that is, science, technology, engineering, and mathematics," said Darryl Mitchell of Goddard's IPP Office.

A Video Contest

The NASA OPTIMUS PRIME Spinoff Award is a video contest that encourages students to read NASA's *Spinoff* magazine to learn how NASA technologies transform into everyday Earth-based applications. Student contestants will choose one of the spinoffs from the most recent issue of *Spinoff* to feature in a 3- to 5-minute original video they make themselves about why the story they selected is the best NASA spinoff of that year.

After conducting a preliminary screening, NASA will post accepted submissions on a Web site where the public can view and vote on their favorite video in each of two age-defined categories: third through fifth graders and sixth through eighth graders.

A panel of NASA judges—one from each of the 10 field centers and one from Headquarters—will determine the final ranking of the top five entries in each age group as determined by the public voting results. The judges will evaluate these finalists according to the following criteria:

- Understanding: Did the video demonstrate and convey an ageappropriate level of understanding of the technology, the associated NASA project/mission, and the spinoff application/benefit?
- **Persuasiveness:** Was the video captivating and interesting? Was there a compelling argument as to why the chosen spinoff story is the best?
- Originality/Creativity: Did the participants do anything unique or very inventive to explain the story and why it is the best candidate?

The recipients of the OPTIMUS PRIME Award, which will be announced in early 2011, will include not only the student who made the video but also the NASA innovator who developed the original technology and the spinoff company.

A History of Collaboration

Hasbro and NASA have a history of collaboration. In the 1990s, toy designers at the company wanted to create a foam glider that a child could fly with little knowledge of aeronautics. But early in its development, the

NERF Aero Glider had one critical problem: it did not fly so well.

Hasbro turned to NASA and began collaborating with the agency's aeronautical experts. Engineers at NASA's Langley Research Center provided information about how wing design and shape are integral to a glider's performance. In addition to this technical guidance, the Hasbro designers received a hands-on tutorial on the physics of designing and flying gliders. Several versions of the NERF Aero Glider were realized from the collaboration.

Looking Ahead

The contest is being launched in July 2010, and students will have until December to prepare their videos.

"Everyone is a winner in this competition: the contestants, the innovators, the spinoff companies, and more," said IPP Office Chief Nona Cheeks. "The public gains a greater awareness of NASA's technology transfer activities as well as the importance of NASA programs and projects, the NASA researchers who develop innovative technologies used in NASA missions, and the companies that commercialize NASA technology."

For more information about this competition, see the award's Web site at: http://ipp.gsfc.nasa.gov/optimus.

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Call for *NASA Tech Briefs* Magazine Tech Needs Article Ideas

NASA Tech Briefs (http://www.techbriefs.com) is a monthly magazine with a readership of approximately 450,000 that features the latest NASA-developed technologies. The magazine also features a "NASA Tech Needs" article that addresses a technology need for which NASA is seeking a solution.

Goddard Space Flight Center is continuously seeking ideas for Tech Needs articles to submit for publication in *Tech Briefs*. This is a great opportunity for Goddard researchers to reach a broader audience to find viable solutions from industry and academia.

If you are a Goddard civil servant or contractor and have an idea for a Tech Needs article, please e-mail your idea to Laura.R.Walker@nasa.gov. For the submission, please summarize in 400 words or less:

- 1. A statement of the problem that requires a technology solution
- 2. Solutions previously explored
- 3. Specific applications that would benefit from this "new" technology

Feel free to include any graphics or pictures that would help explain the technology need. \blacksquare

Tech Transfer Metrics Second quarter of fiscal year 2010

Patents Issued: 3

Automata Learning Algorithms and Processes for Providing More Complete Systems Requirements Specification by Scenario Generation CSP-Based Syntax-Oriented Model Construction and R2D2C System Requirements Transformation

by Michael G. Hinchey (Code 585), Tiziana Margaria (University of Gottingen, Germany), James L. Rash (Code 588), Christopher Rouff (SAIC), and Bernard Steffen (University of Dortmund, Germany)

Flash Drive Memory Apparatus and Method

by Michael G. Hinchey (Code 585)

Split-Remerge Method for Eliminating Processing Window Artifacts in Recursive Hierarchical Segmentation

by James C. Tilton (Code 606.3)

Patent Applications Filed: 1

Wind and Temperature Spectrometer with Crossed Small-Deflection Energy Analyzer by Federico Herrero (Code 553) and Theodore Finne (Naval Research Lab)

New Technology Reports: 39

Carbon Nanotubes on Titanium Substrates for Stray Light Suppression by John Hagopian (Code 551)

Core Flight Software System (CFS) Memory Dwell Application Version 2

by Nancy Schweiss (Code 582)

CFS Checksum Application Version 2

by Nicholas Yanchic (Code 582)

CFS File Manager Application Version 2

by Susanne Streage (Code 582)

CFS Limit Checker Application Version 2

by David Hardison (Code 580)

CFS Memory Manager Application Version 2

by David Hardison (Code 580)

CFS Stored Command Application Version 2

by Nicholas Yanchic (Code 582)

Core RHSEG Software Package

by James Tilton (Code 606)

Data Distribution System (DDS) and Solar Dynamic Observatory Ground Station (SDOGS) Integration Manager

by Thomas Bialas (Code 564)

Enhanced Sifting Procedures for Empirical Mode Decomposition

by Nicolas Gagarin (Code 663)

Fourier Transform Spectroscopy for Analysis of Surface Contamination and Quality Control

by Diane Pugel (Code 553)

High Speed Data Capture Software

by Susan Valett (Code 587)

Highly Efficient, Compact, Wavelength Converters for Pulsed and CW Laser Sources Used in Lidar-Based Remote Sensing and Ranging Systems

by Christopher Kaleve (AdvR, Inc.)

Innovative Thermal Control Method for High Current Wire Bundles by Injecting Thermally Conductive Filler Inside Bundle

by Juan Rodriguez-Ruiz (GSFC/Jackson & Tull)

Land Information System (LIS) Software, Version 6.0

by Christa Peters-Lidard (Code 614.3)

LIS Verification Toolkit-LVT

by Sanjay Kumar (SAIC)

Launch Method for Kites in Low Wind or No Wind Conditions

by Rishi Kurichh (GSFC/Emergent Space Technologies, Inc.)

Lidar-Based Navigation System (LNS)

by Peyush Jain (Code 587)

Lossless Hyper-/Multi-Spectral Data Compression Software

by Penshu Yeh (Code 560)

Low-Noise Large-Area Quad Photoreceivers Based on Low-Capacitance Quad Photodiodes

by Abhay Joshi (Discovery Semiconductors, Inc.)

Low Power, Self Calibrated Vector Magnetometer by David Hovde (Southwest Sciences, Inc.)

MEMO Facility: A High Accuracy, Cryogenic, Non-Contact Photogrammetry Test Bed for Microstructures

by Victor Chambers (GSFC/UMCP/Ball Aerospace & Technology Corporation)

Modular Reconfigurable Rapid-Assembly Structure for Small Spacecraft

by Jaime Esper (Code 592)

New Technology Ground Support Equipment (NTGSE) 4.0 by Rene Zelaya (Code 583)

Next Generation Microshutter Arrays for Large Format Imaging and Spectroscopy

by Harvey Mosley (GSFC/UMCP/MEI Technologies)

Phase Controlled Magnetic Mirror for Wavefront Correction

by John Hagopian (Code 551)

Photonic Choke-Joints for Dual-Polarization Waveguides by Edward Wollack (Code 665)

Programmable Aperture with MEMS Microshutter Arrays by Harvey Mosley (GSFC/UMCP/Catholic University of America)

Programmable High-Rate Multi-Mission Receiver for Space Communication

by Thomas Drago (Summation Research, Inc.)

Remote Data Exploration with the Interactive Data Language

by Michael Galloy (Tech-X Corporation)

Spacebook

by Gregory Martin (Indus Corporation)

SpaceCube Starter Kit by Gary Crum (Code 587)

Switching Dual Thermal Radiators to Cool Detectors in Space by Using Mini-Loop Heat Pipes

by Michael Choi (Code 545)

Technique for Measuring the In-Process Figure, Final Prescription, and System Alignment of Large Optics Using Lidar Metrology

by Raymond Ohl (Code 551)

Total Verification System and C++ Based Verification Test Bench

by Omar Haddad (Dell Perot Systems)

Transportable Magnetic Characterization and Dipole Moment Analysis System

by Todd Bonalsky (Code 549)

Two-Stage Winch for Kite Retrieval

by Ted Miles (Code 569)

Using Photonic Crystal Fiber (PCF) Techniques to Build Novel Planar Waveguides (PWG)

by Mark Stephen (Code 554)

XML Telemetric & Command Exchange (XTCE) Portable Viewer version 1.0 (Beta)

by Dan Smith (Code 583)

Goddard IPP Business Networking and Outreach

he Goddard Innovative Partnerships Program (IPP) Office planned and participated in a broad range of networking and business outreach activities in the January through March 2010 timeframe to engage and educate innovators, program managers, and potential partners about the collaborative opportunities that IPP provides. Recent business networking and recognition events assisted Goddard IPP Office's in furthering their:

- Role to identify opportunities within NASA to leverage technologies and capabilities from one mission/project to another
- Efforts to define technology transfer best practices
- Goal of demonstrating Goddard's positive impacts on the Maryland state economy
- Intent to license Goddard-developed technologies and establish new commercial partnerships
- Strategies to improve NASA's return on investment from partnerships with small businesses
- Leadership role with technology transfer and licensing professionals by presenting papers and participating in panel discussions at national conferences
- Creative strategies for making NASA-developed technologies available for license

Third Annual GSFC Science Poster Party

(January 28, 2010 - Greenbelt, Maryland)



IPP staff members and guests at the Third Annual GSFC Science Poster Party enjoyed the IPP Office booth, featuring new engineering and technology innovations.

Members of Goddard's IPP Office staffed a booth at this third-annual Science and Engineering Directorate (SED) onsite event. To foster enhanced communication and cooperation between directorates for technology reporting purposes, IPP encouraged attendees to learn more about IPP's role in managing new technology reporting, outreach via NASA partnership development and success stories, and recognition for accomplishments.

NASA's PM Challenge 2010 "Above and Beyond"

(February 9-10, 2010 – Galveston, Texas)
Representatives of Goddard's IPP Office attended the seventh annual Project Management Challenge event. During the event, Goddard IPP team members moderated a panel discussion and gave presentations on "Innovation in Intellectual Property Management," and "Reuse of Software by Programs and Projects." This yearly event, attended by 5,000 NASA civil servant and contractor personnel, enables Goddard's IPP to showcase Goddard technology transfer and capability successes, both internal to multiple NASA missions

as well as externally for commercialization and

partnership development.



Goddard's IPP team members moderated a panel session, gave presentations, and helped staff an exhibit booth at NASA's PM Challenge 2010.

NASA Day at Maryland Capitol

(February 23, 2010 - Annapolis, Maryland)

This annual event sponsored by the Goddard Legislative Affairs Office, provides an excellent opportunity to help Maryland lawmakers, students, and other attendees gain a better understanding of Goddard's scientific achievements and positive economic impacts. Supporting the Hubble Space Telescope (HST) theme for the event, six members of the Goddard IPP team hosted a booth that highlighted HST technologies and spinoffs. Nona Cheeks, Goddard's IPP chief, and IPP technology managers met with Maryland representatives to increase the visibility of Goddard's contributions to the state.



IPP Office staff members host a booth at the NASA Day at Maryland Capitol event (L-R): Elizabeth Aleiner, Laura Walker, and Melissa Jackson.



IPP staff member Elizabeth Aleiner chats with astronaut John Grunsfeld at the NASA Day at Maryland Capitol event. Grunsfeld played a key role in repairing HST during the fourth servicing mission.

Pittcon 2010

(February 28, 2010-March 5, 2010 - Orlando, Florida)

Ted Mecum and Elizabeth Aleiner, both of Goddard's IPP Office, attended the Pittcon[®] 2010 conference and exposition with over 16,000 other technology



IPP staff member, Ted Mecum, assists a participant visiting the Goddard booth at Pittcon 2010.

professionals from over 80 countries. The Pittcon conference is the premier annual conference and exposition on the laboratory sciences, such as analytical chemistry and instrumentation. Goddard's IPP Office attended the conference to introduce new Goddard technologies, with the goal of licensing them or establishing partnerships to further the technology.

SBIR Pilot Program with Prime Contractors

(March 2, 2010 - Linthicum, Maryland)

Darryl Mitchell, Goddard IPP technology manager, and representatives from several other NASA field center Small Business Innovation Research (SBIR) offices met with Northrop Grumman representatives to learn about a new SBIR pilot program being implemented among several prime contractors and the Department of Defense. The purpose of the meeting was to evaluate the potential for implementing a similar pilot program at NASA to improve the return on investment available from the SBIR efforts.

AUTM Annual MeetingSM: Building a Stronger Community

(March 18-20, 2010 – New Orleans, Louisiana)
Goddard IPP chief, Nona Cheeks, attended the annual meeting of the Association of University Technology Managers® (AUTM®) organization, with 1,600 in attendance. AUTM's members represent intellectual property managers from more than 300 universities, research institutions, teaching hospitals, businesses, and government agencies. Cheeks participated in a panel discussion, presented the paper "NASA Goddard's Open Innovation," and met with industry and academic attendees to identify leads for licenses and partnerships.

ICAP Ocean Tomo IP Think Tank and Live Auction

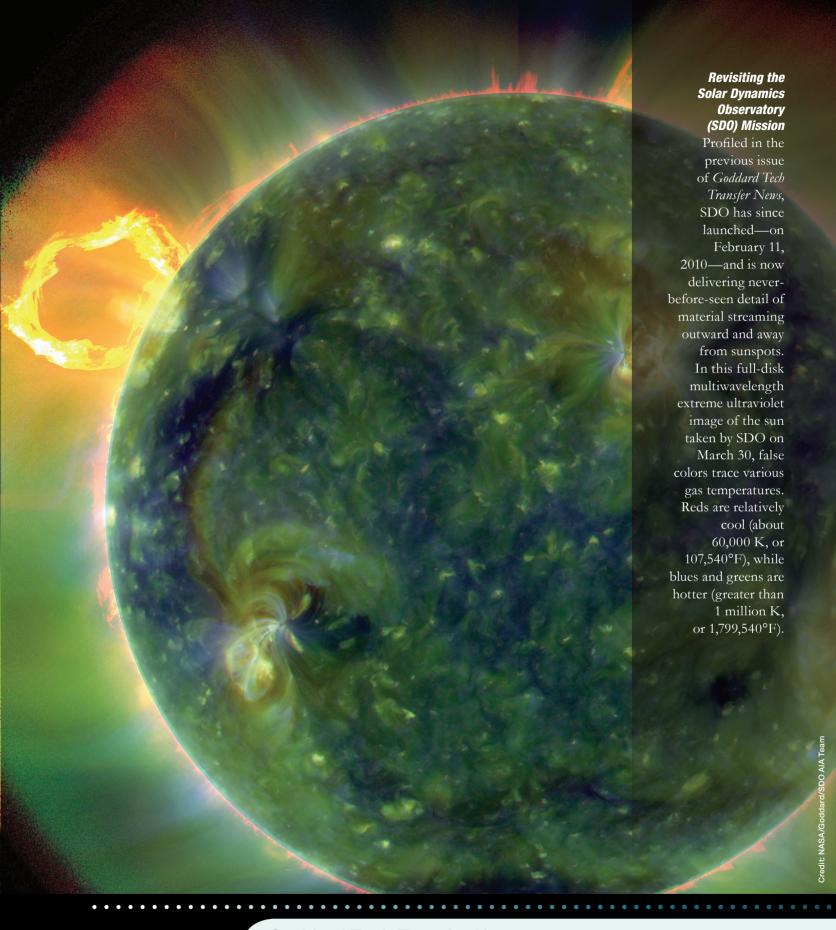
(March 24-25, 2010 – San Francisco, California)
IPP staff participated in the spring 2010 ICAP
Ocean Tomo conference, which included a live
auction of several Goddard patent portfolio
technologies. ICAP Ocean Tomo is a global
intellectual property brokerage company that
assists Goddard's IPP Office with transfer of
NASA-developed technologies to the private
sector for commercialization. ■

Pitton is a registered trademark of The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, a Pennsylvania non-profit organization.

AUTM Annual Meeting is a service mark and Association of University

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Goddard Tech Transfer News http://ipp.gsfc.nasa.gov

Chief: Nona Cheeks (301) 286-5810 Nona.K.Cheeks@nasa.gov Goddard Tech Transfer News is the quarterly magazine of the Innovative Partnerships Program Office (Code 504) at NASA's Goddard Space Flight Center. Also available online at: http://ipp.gsfc.nasa.gov. Send suggestions to alfred.t.mecum@nasa.gov.